

7. Ozone (O₃)

Ozone is a highly reactive colorless gas that is harmful to people, animals, vegetation, and materials even at very low exposure levels. The most widespread criteria air pollutant in North Carolina, ozone is the major component of a complex mixture of compounds known as photochemical oxidants, or smog.

Ozone also occurs naturally in the upper atmosphere (stratosphere), where it shields the earth from harmful effects of ultraviolet solar radiation. Stratospheric ozone can be damaged by emissions of chlorofluoro-hydrocarbons (CFCs) such as Freon.

Sources

Ozone is not a source specific pollutant for which specific controls can be established. Instead it is formed in the lower atmosphere by a series of complex chemical reactions involving atmospheric oxygen, nitrogen oxides (NO_x), and reactive hydrocarbons known as volatile organic compounds (VOCs). Key factors that promote the formation of ozone are sunlight, elevated temperatures and low wind speeds—conditions usually associated with high pressure systems that develop over North Carolina during the summer. It is estimated that 90 percent of all atmospheric NO_x is from the combustion of fossil fuels; coal, petroleum, and natural gas. Transportation (highway and off-highway vehicles) and stationary fuel combustion (electricity generating plants and industrial furnaces/boilers), respectively, are the two largest sources of NO_x. VOCs primarily are emitted by industrial processes, transportation activities, and vegetation. Industrial processes (chemical manufacturing, petroleum processing, and waste disposal), and highway vehicles account for most of the manmade hydrocarbon emissions. These industrial and transportation based emissions are concentrated around the major population centers and areas of highest ozone concentrations. Vegetative or biogenic VOC emissions are seasonal with the majority entering the atmosphere during the summer months. These biogenic VOC emissions are distributed across the entire state and create the background levels during the spring, summer, and fall ozone season, onto which manmade VOC emissions are added.

Ozone is considered a seasonal pollutant in North Carolina. The ozone season and monitoring period in North Carolina is from late spring to early autumn. This is when the temperature is above 60°F, sunlight is more intense, and high pressure systems with associated light winds occur frequently. At most sites, ozone concentrations peak in the mid to late afternoon and decrease during the night.

Effects

Ozone is harmful to both people and animals, although the complete effects are still under intense investigation. Exposure to low levels of ozone can cause respiratory problems, aggravate asthma, cause temporary decreases in lung capacity, and cause inflammation of lung tissue. Ozone exposure also impairs the body's immune system, resulting in an increased incidence of respiratory infections such as pneumonia and bronchitis. As the concentration, length of exposure, and frequency of exposure increases, the severity of adverse effects also increases. Significant associations have been found with elevated ozone